1. Using general properties of vectors, show that

$$\|\vec{\mathbf{v}} + \vec{\mathbf{w}}\|^2 + \|\vec{\mathbf{v}} - \vec{\mathbf{w}}\|^2 = 2\left(\|\vec{\mathbf{v}}\|^2 + \|\vec{\mathbf{w}}\|^2\right).$$

Hint: write lengths in terms of dot products and simplify!

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2. Using general properties of vectors, show that

$$(\vec{\mathbf{v}} \times \vec{\mathbf{w}}) \cdot (\vec{\mathbf{v}} \times \vec{\mathbf{w}}) = (\vec{\mathbf{v}} \cdot \vec{\mathbf{v}})(\vec{\mathbf{w}} \cdot \vec{\mathbf{w}}) - (\vec{\mathbf{v}} \cdot \vec{\mathbf{w}})^2.$$

Hint: first make sure the equation holds if at least one of the vectors is zero. Otherwise let θ be the angle between $\vec{\mathbf{v}}$ and $\vec{\mathbf{w}}$, write dot products in terms of lengths and θ, and simplify!

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3. Find the area of the triangle with vertices $A(3, 1, -1)$, $B(2, 0, 1)$, $C(1, -2, 0)$.

Hint: this triangle is half of some parallelogram. Can you find the area of that parallelogram?
